

1 **CLAIMS**

2 We claim:

3  
4 1. A method comprising:

5 identifying, in response to a search query, first multimedia objects having  
6 an associated keyword that matches a keyword in the search query and second  
7 multimedia objects that have content features similar to those of the first  
8 multimedia objects;

9 presenting the first and second multimedia objects to a user;

10 monitoring feedback from the user as to which of the first and second  
11 multimedia objects are relevant to the search query;

12 annotating one or more of the multimedia objects, which are deemed  
13 relevant by the user, with the keyword.

14  
15 2. A method as recited in claim 1, further comprising:

16 maintaining associations between the keywords and the multimedia objects,  
17 the associations being weighted to indicate how relevant the keywords are to the  
18 multimedia objects; and

19 adjusting the weights of the associations based on the user's feedback.

20  
21 3. A method as recited in claim 2, wherein the adjusting comprises  
22 increasing a weight of an association between the keyword and a particular  
23 multimedia object that is deemed relevant by the user.  
24  
25

1           4.    A method as recited in claim 2, wherein the adjusting comprises  
2 decreasing a weight of an association between the keyword and a particular  
3 multimedia object that is deemed irrelevant by the user.

4  
5           5.    A method as recited in claim 4, further comprising removing the  
6 keyword from the particular multimedia object in an event that the weight is less  
7 than a threshold value.

8  
9           6.    A method as recited in claim 1, further comprising training how the  
10 first and second multimedia objects are identified based on the user's feedback.

11  
12           7.    A method as recited in claim 1, further comprising refining the search  
13 to identify additional multimedia objects that contain content features similar to  
14 those of the multimedia objects indicated by the user as being relevant.

15  
16           8.    A method as recited in claim 1, wherein the multimedia objects  
17 comprise one of digital images, video objects, and audio objects.

18  
19           9.    A computer readable medium having computer-executable  
20 instructions that, when executed on a processor, perform the method as recited in  
21 claim 1.

**10. A method comprising:**

iteratively retrieving multimedia objects from a database and monitoring feedback from a user as to whether the multimedia objects are relevant to a keyword in a search query; and

annotating the multimedia objects based on the user's feedback.

11. A method as recited in claim 10, wherein the retrieving comprises using content-based information retrieval to retrieve the multimedia objects.

12. A method as recited in claim 10, wherein the retrieving comprises using both content-based information retrieval and semantic-based information retrieval to retrieve the multimedia objects.

**13.** A method as recited in claim 10, wherein the monitoring comprises monitoring both feature-based relevance feedback and semantic-based relevance feedback.

**14.** A method as recited in claim 10, wherein the annotating is hidden from the user.

15. A method as recited in claim 10, wherein the annotating comprises:

in an event that a particular multimedia object is deemed relevant by the user and is not yet annotated with the keyword, adding the keyword to the particular multimedia object; and

1 in an event that the particular multimedia object is deemed relevant by the  
2 user and is already annotated with the keyword, strengthening an association  
3 between the keyword and the particular multimedia object.

4  
5 **16.** A method as recited in claim 10, wherein the annotating comprises:  
6 in an event that a particular multimedia object is deemed irrelevant by the  
7 user and is already annotated with the keyword, weakening an association between  
8 the keyword and the particular multimedia object.

9  
10 **17.** A computer readable medium having computer-executable  
11 instructions that, when executed on a processor, perform the method as recited in  
12 claim 10.

13  
14 **18.** A method comprising:  
15 retrieving multimedia objects according to a content-based retrieval  
16 process;  
17 presenting the multimedia objects to a user;  
18 monitoring feedback from the user as to which of the multimedia objects  
19 are relevant; and  
20 annotating one or more of the multimedia objects based on the user's  
21 feedback.

1       **19.**     A method as recited in claim 18, wherein the monitoring comprises  
2 monitoring both feature-based relevance feedback and semantic-based relevance  
3 feedback.

4  
5       **20.**     A method as recited in claim 18, wherein the annotating is hidden  
6 from the user.

7  
8       **21.**     A method as recited in claim 18, wherein the annotating comprises:  
9 in an event that a particular multimedia object is deemed relevant by the  
10 user and not yet annotated with the keyword, adding the keyword to the particular  
11 multimedia object; and

12 in an event that the particular multimedia object is deemed relevant by the  
13 user and is already annotated with the keyword, strengthening an association  
14 between the keyword and the particular multimedia object.

15  
16       **22.**     A method as recited in claim 18, wherein the annotating comprises:  
17 in an event that a particular multimedia object is deemed irrelevant by the  
18 user and is already annotated with the keyword, weakening an association between  
19 the keyword and the particular multimedia object.

20  
21       **23.**     A method as recited in claim 18, wherein the annotating comprises:  
22 in an event that a particular multimedia object is deemed irrelevant by the  
23 user and is already annotated with the keyword, removing the keyword from the  
24 particular multimedia object.  
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1       **24.**   A computer readable medium having computer-executable  
2 instructions that, when executed on a processor, perform the method as recited in  
3 claim 18.

4  
5       **25.**   A method comprising:  
6       maintaining associations between keywords and multimedia objects, the  
7 associations being weighted to indicate how relevant the keywords are to the  
8 multimedia objects; and  
9       retrieving a set of one or more multimedia objects for presentation to a  
10 user;  
11       monitoring feedback from the user as to which of the multimedia objects  
12 are relevant; and  
13       adjusting the weights of the associations based on the user's feedback.

14  
15       **26.**   A method as recited in claim 25, wherein the retrieving comprises  
16 using content-based information retrieval to retrieve the multimedia objects.

17  
18       **27.**   A method as recited in claim 25, wherein the retrieving comprises  
19 using both content-based information retrieval and semantic-based information  
20 retrieval to retrieve the multimedia objects.

21  
22       **28.**   A method as recited in claim 25, wherein the monitoring comprises  
23 capturing both feature-based relevance feedback and semantic-based relevance  
24 feedback.  
25

1       **29.**    A method as recited in claim 25, wherein the adjusting comprises  
2 increasing the weights of the associations between the keywords and the  
3 multimedia objects that are deemed relevant by the user.

4  
5       **30.**    A method as recited in claim 25, wherein the adjusting comprises  
6 decreasing the weights of the associations between the keywords and the  
7 multimedia objects that are deemed irrelevant by the user.

8  
9       **31.**    A computer readable medium having computer-executable  
10 instructions that, when executed on a processor, perform the method as recited in  
11 claim 25.

12  
13       **32.**    A system comprising:  
14       an information retrieval unit to retrieve multimedia objects from a database  
15 based on a search query;  
16       a relevance feedback unit to capture a user's feedback as to whether the  
17 multimedia objects are relevant to the search query; and  
18       an annotation unit to annotate the multimedia objects based on the user's  
19 feedback.

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21       **33.**    A system as recited in claim 32, wherein the search query comprises  
22 a keyword-based search query having one or more keywords.

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1       **34.**     A system as recited in claim 32, wherein the search query comprises  
2 a content-based search query having one or more content features.

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4       **35.**     A system as recited in claim 32, wherein the information retrieval  
5 unit employs both content-based information retrieval and semantic-based  
6 information retrieval.

7  
8       **36.**     A system as recited in claim 32, wherein the information retrieval  
9 unit comprises:

10         a query handler to handle both keyword-based queries having one or more  
11 search keywords and content-based queries having one or more content features of  
12 a multimedia object; and

13         a feature and semantic matcher to identify at least one of (1) first  
14 multimedia objects having keywords that match the search keywords from a  
15 keyword-based query, and (2) second multimedia objects having content features  
16 similar to the content features of a content-based query.

17  
18       **37.**     A system as recited in claim 32, wherein the relevance feedback unit  
19 employs both feature-based relevance feedback and semantic-based relevance  
20 feedback.

21  
22       **38.**     A system as recited in claim 32, wherein:  
23         the search query comprises a keyword-based search query having at least  
24 one keyword; and  
25



1 in an event that a particular multimedia object is deemed relevant by the  
2 user and is not yet annotated with the keyword, the annotation unit adds the  
3 keyword to the particular multimedia object.

4  
5 **39.** A system as recited in claim 32, wherein:  
6 the search query comprises a keyword-based search query having at least  
7 one keyword; and

8 in an event that a particular multimedia object is deemed relevant by the  
9 user and is already annotated with the keyword, the annotation unit strengthens an  
10 association between the keyword and the particular multimedia object.

11  
12 **40.** A system as recited in claim 32, wherein:  
13 the search query comprises a keyword-based search query having at least  
14 one keyword; and

15 in an event that a particular multimedia object is deemed irrelevant by the  
16 user and is already annotated with the keyword, weakening an association between  
17 the keyword and the particular multimedia object.

18  
19 **41.** A system as recited in claim 32, wherein:  
20 the search query comprises a keyword-based search query having at least  
21 one keyword; and

22 in an event that a particular multimedia object is deemed irrelevant by the  
23 user and is already annotated with the keyword, removing the keyword from the  
24 particular multimedia object.

1        **42.**    An image retrieval system as recited in claim 32, wherein the  
2 relevance feedback unit comprises a feedback analyzer to train the system based  
3 on the user's feedback.

4  
5        **43.**    A user interface, comprising:  
6            a query interface to accept a search query for searching multimedia objects  
7 in a database system;  
8            a browser to permit a user to browse the multimedia objects returned from  
9 the database system; and  
10           a feedback interface to enable the user to indicate which multimedia objects  
11 are relevant to the search queries.

12  
13        **44.**    A user interface as recited in claim 43, wherein the query interface  
14 is configured to allow entry of both keyword-based queries with one or more  
15 keywords and content-based queries based on selection of an example multimedia  
16 object.